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# Phytochemical Screening, Anti-nutritional and Mineral Composition of *Telfairia occidetallis* (Fluted Pumpkin) and *Cleome rutidosperma* (Fringe Spider Flower)

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author PA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors PA and IBB managed the analyses of the study. Author AB managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

The study was conducted to investigate phytochemicals, anti-nutrients and mineral compostions of *Telfeira occidentalis* and *Cleome rutidospermas* leaves. The High Performance Chromatography (HPLC) was used in the Quantitative analysis of Phytochemicals as well as the anti-nutrient contents while the Elemental Compositions was analysed using Atomic Absorption Spectrophotometer (AAS) (Buck Scientific). The antinutrients content analysed were as follows hydrocyanic acid (31.0±0.001 and 25.0±0.001), oxalate (570±0.004 and 740±0.003), phytic acid (7.50±0.002 and 9.20±0.005 mg/100 g), for *T. occidentallis* and *C. rutidosperma* respectively and the values were all within the NAFADAC/WHO tolerable limit. The Minerals Compositions was found to be, Mn (1.684±0.40 and 0.718±0.31 mg/100 g), Zn (1.740±0.10 and 1.570±0.31 mg/100 g), Fe (3.823±0.03 and 4.329±0.01 mg/100 g), Na (2.572±0.42 and 2.659±0.80 mg/100 g), Ca (74.405±13.60 and 29.677±13.50 mg/100 g), Mg (35.277±10.05 and 12.438±10.4 mg/100 g), Cu (0.049±0.03 and 0.044±0.01 mg/100 g) for *T. occidentallis* and *C. rutidosperma* respectively. The

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presences of some secondary metabolites like alkaloids, flavonoids, terpenoids, tannins, cardiac glycosides and some essential minerals shows that the plants can be alternative sources of medicine. The results of the antinutrients indicated that the samples are free of toxic substances which might cause ill health to the body. Though, the anti-nutrient contents found in both *T. occidentallis* and *C. rutidosperma* were low, it will still be safer if these leaves were boiled for about 5 to 15 minutes to reduce the anti-nutritional factors significantly.

*Keywords: Phytochemical screening; anti-nutritional; mineral composition; Telfairia occidetallis; Cleome rutidosperma.*

## 1. INTRODUCTION

*T. occidentallis* (fluted pumpkin), is a tropical vine grown in West Africa as a leaf vegetable and for its edible seeds. It is dioecious and perennial commonly known as *"Ugwu"* in Igbo language and is a creeping vegetable that spread across the ground with lobed leaves and twisting tendrils [1]. The fluted gourd grows in many West African countries but is mainly cultivated in Nigeria especially among the Igbos, the fresh leaves of the plant are used primarily in soups and herbal medicines [2]. *T. occidentallis* leaves and seeds have a lot of nutritive values, this gives the leaves, seeds and tender stems some potential values to be use as food supplements [3]. Study by Oboh et al. [4] shows that the leaves of *T. occidentallis* contain high amount of vitamins A and C, antioxidants, hepato-protective and antimicrobial properties. Report according to Eseyin et al. [5] stressed that the leaf extract is also useful in the management of cholesterolemia, liver problems and impaired defense immune systems. According to several findings by Abu et al. [6]; Okoli and Mgbeogwu [7] and Eseyin et al. [5], the leaves are rich in iron and play a key role in the cure of anaemia; they are also known for their lactating properties and are in high demand for nursing mothers. In Nigeria for instance, the fresh leaves are ground and the liquid extract is used as tonic for women that have just given birth; the high iron content of the leaves helps in the replenishment of the lost blood [8]. *T. occidentallis* belongs to the family Cucurbitaceae and the leaves play important role in human and live stock nutrition as it is believed to be source of protein, carbohydrates, minerals and vitamins [9]. Fresh leaves of fluted pumpkin are used for the treatment of anaemia, chronic fatigue, diabetes, sudden attack of convulsion and malaria [10,11].

The analgesic, antipyretic, anti-inflammatory, anti-microbial, diuretic, laxative antioxidant and anti plasmodial activities of *Cleome rutidosperma* plant have already been reported *Bose et al.,* [12]. *Cleome rutidosperma* is traditionally used in the treatment of paralysis, epilepsy, convulsions, spasm, earache, pain and skin disease [13]. *Cleome rutidosperma* is palatable to humans and is sometimes eaten as a cooked vegetable [14]. Report according to Ojiako and Igwe [15] emphasied that Cleome rutidosperma is a common annual weed that belongs to the Capparaceae family. It attains about 90 cm in height and occurs in West and East Africa. The leaves are edible and have alleged medicinal uses.

The rate of vegetable consumption in Nigeria like rest of Africa countries has shown an indiscriminate pattern which is an indication that most people are not aware of anti-nutrients contents in most of plants. In most cases, green leafy vegetables despite their nutritional value are to be consumed with caution because of the presence of toxic anti-nutrients [16]. Anti-nutrients are natural compounds that interfere with the absorption of nutrients, hence are known to reduce nutrients availability to animals and humans [17]. Among vegetables that are highly consumed in Nigeria are *T. occidentallis and C. rutidosperm*a. Therefore, this study is to determine the phytochemical screening, anti-nutritional and mineral composition of *T. occidentallis* (fluted pumpkin) and *C. rutidosperma* (fringe spider flower) leaves consumed in Mubi metropolis of Adamawa State, North-Eastern Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Sample Collection

Fresh samples of *T. occidentallis and C. rutidosperma* were randomly collected in Mubi North Local Government Area, along River Yadzaram at Mallam Adamu farms in Mubi North, Adamawa State, Nigeria. Fresh leaves samples were collected from the farms into a

labeled large size brown envelope in order to preserve its coloration and moisture content, then, was taken to the laboratory for analysis. The samples were identified in the Department of Biological sciences Adamawa State University, Mubi, Nigeria [18].

## 2.2 Sample Preparation

The collected fresh leaves samples of *T. occidentallis and C. rutidosperma* were taken to the laboratory and washed thoroughly with ordinary tap water to removed dirt, dust and other contaminants, and then they were further, washed with distilled water and were allowed to drip. About 5 g of each of the leaves samples were analysed for moisture content then the remaining plants leaves samples were air-dried at room temperature. The dried plant leaves were crush, ground into fine powder using mortar and pestle in the laboratory and then homogenize using laboratory blender. The powdered samples were sieved using 90 micron sieve and stored in polyethylene air- tight containers for further processing. The powdered samples were use for anti-Nutrient, mineral and phytochemicals analysis [19].

## 2.3 Sample Extraction

About 20 g of each dry powdered sample were subjected for soxhletation in 200 $cm^3$ of ether. 20 g of each powdered plants sample were weighed and placed into the thimble of soxhlet apparatus and then the extraction process was carried out with 200$cm^3$ of ether in round bottom flask at temperature 70°C, the extract was collected in a round bottom flask, then evaporated with the aid of rotary evaporator at constant temperature of 60°C with reduced pressure for 2 hours [20].

## 2.4 Determination of Phytochemicals

Phytochemical analysis for the screening and identification of bioactive chemical constituents such as flavonoids, terpenoids, alkaloids, glycosides, steroids, saponins, osozone, and tannins of the leaves extracts were determined qualitatively and quantitatively using standard procedures as described by AOAC, [19]; Edeoga et al. [20] and Sofowora [21] with slight modification

## 2.5 Qualitative Determination

### 2.5.1 Test for tannins

About 0.5 g of each of the dried powdered sample was boiled in 20 $cm^3$ of distilled water in a test tube and then filtered. Few drops of 0.1% ferric chloride was added a blue –black coloration was observed, which indicated the presence of Tannins.

### 2.5.2 Test for saponins

About 2.0 g of each of the powdered sample was boiled in 20 $cm^3$ of distilled water and then was filtered. Then 10 $cm^3$ of the filtrate was mixed with 5 $cm^3$ of distilled water and shaken vigorous in anticipation of a persistent froth. The following were mixed with 3 drops olive oil and shaken vigorous, and then emulsion was observed.

### 2.5.3 Test for flavanoids

About 5 $cm^3$ of dilute ammonia solution was added to a portion of aqueous filtrate of each of the plant extract, then concentrated sulphuric acid was added dropwise. A yellow coloration was observed in each extract indicating the presence of flavanoids. The yellow coloration disappears on standing also on addition of aluminum solution (1%) to a portion of each filtrate A yellow coloration was observed showing the presence of flavanoids.

### 2.5.4 Test for terpenoid (salkowsky test)

About 5 $cm^3$ of each of the extract was treated with 2 $cm^3$ of chloroform and concentrated sulphuiric acid (3 $cm^3$) which was carefully added to form a layer. A reddish brown coloration of the interface was formed that shows a positive result for the presence of terpenoids.

### 2.5.5 Test for cardiac glycocides (keller kilani test)

About 5 $cm^3$ of each extract was treated with 2 $cm^3$ of glacial acetic acid containing 1 drop of ferric chloride solution. This was under layed with 1 $cm^3$ of concentrate sulphuric acid then a brown ring of the interface indicates a violet ring, below the brown ring.

### 2.5.6 Test for steroids

About 2 $cm^3$ of acetic anhydride was added to 0.5 g ethanolic extract of each sample with 2 $cm^3$ of sulphuric acid. A color change from violet to blue or green in same sample indicates the presence of steroids.

### 2.5.7 Test for alkaloids (hagers test)

About 1 $cm^3$ of filtrate in a test tube was mixed with 3 drops of hagers reagent a yellow

precipitate evolves which indicates the presence of alkaloids.

## 2.6 Quantitative Determination

The Quantitative determination of the phytochemicals was done using the method described by (AOAC [19] with High Performance Liquid chromatography, (HPLC). 2.5 g of the dried extracts obtained from soxhletation was dissolved in HPLC grade methanol and then sterilized by membrane filtration. 1.0 ul of the filtrate was injected into a Buck Scientific (USA) BLC 10/11 High performance Liquid chromatography system with fluorescence detector (excitation at 295 nm and emission at 325 nm) with an analytical silica column (25 cm ±4.6 mm ID, stainless Steel, 5 nm) was used in the analysis of phytochemicals. The mobile phase used was hexane: Tetrahydrofuran: Isopropanol (1000: 60: 4 v/v/v) at a flow rate of 1.0 cm3/min. Stock and serial concentrations of standards of each phytochemicals were sought. Concentration of the phytochemicals in the samples was calculated.

$$Phyto = \frac{A\ sample\ \times STD\ (ppm) \times V\ Hex(cm^3)}{ASTD\ \times Wt\ of\ sample\ (g)}$$

Where,

phyto = Concentration of photochemical in ppm , A sample = Peak area of sample, STD = Peak area of standard, V Hex = Volume of Hexane, Wt Sample = Weight of the Sample.

## 2.7 Proximate Analysis

Proximate analysis (moisture, ash, protein, fat, fibre and CHO) were determined using standard method of AOAC. [19] and Okonwu et al. [22].

## 2.8 Determination of Moisture Content

A clean dry crucible was placed in an oven at 80°C for about 30 minutes, cooled in a desiccator and weighed as (w). 5g of the samples was added to the crucible and weighed as (b). The crucible and its content were placed in an oven adjusted to 70°C. After 5 hours, the crucible containing the sample was removed and quickly transferred to a desiccator for cooling. The crucible was put back into the oven and adjusted to 105°C for another 5 hours after which it was removed, put in desiccator for cooling. This process was repeated and weighed until a constant weight (c) was obtained.

The % moisture content was determined as follows

$$\% \text{ Moisture content} = (b–c/b-w) \times 100$$

Where,

w = weight of moisture content; b = weight of crucible + sample; c = weight of crucible + sample after drying

## 2.9 Determination of Ash Content

An empty crucible was first ignited in a muffle furnace for 1min and allowed to cool in a desiccator containing silica gel. 5g of the sample was accurately weighed into the preheated crucible. The weight of the crucible and the samples were noted. It was heated gently over a Bunsen burner until the sample was charred and then transferred into a muffle furnace at 550-570°C for about 18-24hours to burn off all organic matter. After ashing, the crucible was removed from the furnace and placed in desiccator to cool at room temperature and weighed. The percentage ash content of the sample was calculated thus;

$$\% \text{ Ash} = (\text{weight of ash/weight of sample}) \times 100 = (W_3 – W_1/W_2 – W_1) \times 100$$

$W_1$= weight of empty crucible; $W_2$= weight of crucible + sample before ashing; $W_3$= weight of crucible + sample after ashing.

## 2.10 Determination of Crude Fiber

About 2 g of the defatted sample was weighed into conical flask and 200 mls of 1.25% of boiling sulphuric acid was added within a minute. The content of the flask was filtered through a buchner funnel prepared with wet 12.5 cm filter paper. The sample was washed back into the original flask with 200 mls of 1.25% NaOH, and boiled for 30 mins. All insoluble matter was transferred to the crucible and treated till the sample was free from acid. The sample was again ashed in a muffle furnace at 550°C/hr. The crucible was then cooled in desiccator and reweighed.

$$\% \text{ Crude Fiber} = (W_2 - W_1 / W) \times 100$$

Where,

W = weight of sample; $W_1$= weight of crucible+ sample; $W_2$ = weight of crucible+ filter paper after ashing.

## 2.11 Determination of Crude Protein

About 1 g of the sample was weighed and transferred into Khedahl flask. Few chips of antibumping granules, 4 g of digestion catalyst and 20 mls of conc. sulphuric acid were added at a 40°C angle with a retort stand on an electro thermal heater. The flask was gently heated for frothing to occur and subside, and then heat was increased to about 250°C. The digestion was carried out within 2-6 hours by which time the entire sample was digested completely. The digest was cooled to room temperature and diluted to 100 mls with distilled water. For distillation, 20 mls aliquot of the digest was transferred into a round bottomed flask. This flask was connected to a Liebig condenser through a monoarm steel head (Adaptor). The liebig condenser was connected to a receiver flask through a receiver adapter. 10 mls of 2% boric acid and two drops of double indicator were pipetted into the distillation flask. 30 mls of 40% sodium hydroxide was injected into the distillation flask through a cork with the aid of asyringe. The flask was heated for 10 mins to digest the content. The distillate was collected in the boric acid and then titrated with 0.1M HCL. The vol. of HCl added was recorded as the titre value. The % Crude protein was calculated thus;

% Crude protein = % Nitrogen x 6.25

% Nitrogen = (titre value x 1.4 x 100 x 10/1000 x wt of sample x aliquot digest)

Where, 1.4 = $N_2$ equivalent to 0.1NHCl used in titration;

100 = Total volume of digest

## 2.12 Determination of Lipid

About 5 g of the sample was weighed into a thimble and was extracted with petroleum ether until it siphons using the Soxhlet extraction method. The lipid was exhaustively extracted using petroleum ether at 40 – 60°C for 6 hrs. The sample in the thimble was removed and dried in air at 50°C for 5 mins, cooled in a desiccator and weighed. The % lipid content was calculated as follows;

% Lipid = (weight of sample (extracted fat)/ Weight of sample) x 100

Where

$W_1$= weight of empty thimble; $W_2$ = weight of thimble + sample; W = weight of sample used

## 2.13 Determination of Total Carbohydrate

The total carbohydrate content of the sample was estimated as the Nitrogen free extract (NFE). The arithmetic different methods involve adding the total percentage values of crude volume.

Total CHO = 100 – (%fibre + %protein + %Moisture + %ash + %fats)

Where,

W = weight of sample; $W_1$= weight of empty filter paper $W_2$ = weight of filter paper of ppt.

## 2.14 Anti-Nutritional Analysis

Determination of Antinutrient was carried out using High performance Liquid chromatography (HPLC) Buck scientific USA, BLC10/11 – model. HPLC equipped with UV 320nm detector, a (C-18), 5u, 150 x 4.6 mm column and a mobile phase of 70:30 met: $H_2O$ was used at a flow rate of 0.45 mL/ minute and an ambient operating temperature. A 0.1 mg of mixed standards were analysed in a similar manner for identification. Peak identification was conducted by comparing the retention times of authentic standards and those obtained from the samples. Concentrations were calculated using a four point calibration curve [19].

## 2.15 Elemental Analysis

Mineral analysis was carried out by method described by Imaga *et al.* [23]. About 2g of each plants sample were subjected to dry Ashing in a well clean porcelain crucible at $550^0$C in a muffle furnace. The resultant ash was digested in $5cm^3$ of concentrated nitric acid, Hydrochloric acid, and water in the ratio 1:2:3 respectively, then it was heated, gently until brown fumes disappear. To

the remaining materials in each crucible, 5 $cm^3$ of distilled water was added and heated until a colorless solution was obtained and the mineral solution in each crucible was transferred to 100 $cm^3$ volumetric flask through filtration with Whatman filter paper (No. 42) and the volume was filled to mark with distilled water. Then the filtered solution was loaded to an atomic absorption spectrophotometer bulk scientific 200A to determine Calcium, Iron, zinc, copper, and magnesium.

## 3. RESULTS AND DISCUSSION

### 3.1 Phytochemical Screening

The results of the phytochemical screening of the leaves extracts of *T. occidentallis* and *C. rutidosperma* plants indicated the presence of tannins, alkaloid and flavonoids while terpenoids and cardiac glycosides are absent (Table 1 and Table 2). The result of the quantitative analysis showed higher concentration of tannins in *C. rutidosperma than T. ocidentallis* while the alkaloid content is higher in *T. occidentallis* than in *C. rutidosperma*. This investigation indicated that both plants leaves have bioactive compounds (flavonoids, terpenoids, alkaloids, glycosides, steroids, saponins, osozone, and tannins) which are found in medicinal plants. These metabolites are known to have varied pharmacological actions or applications in man and animals. The investigation showed that the concentration of the phytochemical constituents analysed were significantly higher in *C. rutidosperma*, than in *T. occidentallis* ($p<0.05$), except alkaloids which was significantly higher in *T. occidentallis* than *C. rutidosperma*. These results showed that the bioactive compounds in the plants leaves are more significantly observed in *C. rutidosperma* which indicated higher medicinal values than *T. occidentallis*. This finding is in agreement with the studies by Oyeyemi et al. [24] and Odiaka and Schippers [25]. This result indicated that the medicinal values in *T. occidentallis* is less as compared to the studies according to Nwangwa et al. [26]; Chakraborty, and Roy [27].

### 3.2 Anti-nutrients Constituents

Anti-nutrients are also referred to as nutritional stress factors. These factors may either be in the form of synthetic or natural compounds and they impede nutrient absorption. The commonly occurring anti nutrients in plants includes; cyanide, Phytates, nitrates and nitrites, Phenollic compounds and oxalates among others. As much as green leafy vegetable contains various beneficial nutrients, it also has anti-nutritional and toxic substances, which impair nutrient uptake and absorption of nutrients [28]. The result of anti-nutrients as presented in Table 3, shows that the average values of the anti-nutrients are as follows hydrocyanic acids 31.00±0.001 mg/100 g for *T. occidentallis,* while 25.00 ±0.001 mg/100 g was recorded for *C. rutidosperma* plants. However, the hydrocyanic acids recorded in both plant leaves were within the 35.00 mg/100 g, tolerable limit by WHO. The oxalate value recorded for *T. occidentallis* was 570±0.004 mg/100 g while for *C. rutidosperma,* 740 ±0.003 mg/100 g was observed. The values of oxalate recorded in both plant leaves were within 2000 mg/100 g, the tolerable limit by WHO. The level of phytic acid recorded in *T. occidentallis* was 7.50±0.002 mg/100 g, while in *C. rutidosperma was* 9.20±0.005 mg/100 g. However, the content of phytic acid in both plants exceeded the 5 mg/100 g tolerable limit set by WHO/FAO [29]. The anti-nutrients recorded in the investigated leaves of *T. occidentallis* and *C. rutidosperma* were Hydrocyanic acids, oxalate and phytic acid. However, the values of these anti-nutrients recorded in this study are too small to be harmful for human consumption. Based on the findings of this research, the studied plant leaves were suitable for human consumption;

**Table 1. Qualitative results of phytochemical compositions of *Telfairia occidentallis* and *Cleome rutidosperma* plant leaves**

| Phytochemicals | *T. occidentallis* | *C. rutidosperma* |
|---|---|---|
| Alkaloid | + | + |
| Flavonoids | + | + |
| Tarpenoids | – | – |
| Tannins | + | + |
| Cardiac glycosides | – | – |

*+ Present, - Absent*

**Table 2. Quantitative results of phytochemical compositions of *Telfairia occidentallis* and *Cleome rutidosperma* plant leaves (mg/100 g dry weight)**

| Phytochemicals | *T. occidentallis* | *C. rutidosperma* |
|---|---|---|
| Alkaloid | 712.40±0.08 | 615.30±0.03 |
| Flavonoids | 232.34±0.03 | 312.52±0.06 |
| Tarpenoids | 10.44±0.02 | 13.10±0.03 |
| Tannins | 845.23±0.04 | 892.35±0.07 |
| Cardiac glycosides | 5.30±0.02 | 6.23±0.03 |

*Results were presented as mean ± SD of triplicate determinations*

since the amount of anti-nutrients in them is negligible. This finding is in agreement with the report of Odabasi et al. [30]. However, there is need to boil these vegetables for 5 to 15 minutes in order to reduce the anti-nutritional factors significantly.

## 3.3 Mineral Compositions

The results on mineral compositions as recorded in Table 4 showed that the plant leaves of, *C. rutidosperma* and *T. occidentallis,* are rich in minerals, when compared with other plants, such as legumes and tubers. From the result of the investigation carried out calcium and magnesium are the most predominant elements in *T. occidentallis* and *C. rutidosperma,* however, their amount are higher in *T. occidentallis* than *C. rutidosperma*. According to Skulan et al. [30], calcium is an essential mineral for maintaining healthy bones – a factor in the development of numerous diseases such as osteoporosis, rheumatoid arthritis and others. Calcium is another substance that can be found from many vegetables and green leafy plants. The higher calcium content of the studied plant leaves implies that consuming any of these plants can cater for osteoporosis [31]. The higher level of calcium recorded in both plant leaves reaffirmed that *T. occidentallis* and *C. rutidosperma* as important source of calcium for human. Likewise, Harder et al. [32] expressed that calcium is heavily involved in bone manufacture. Therefore, shortage or lack of calcium can be responsible for many bone diseases, such as hydroxyapatite in molecular structure [32].

The results from this study showed high presence of magnesium in, *T. occidentallis* (35.277±10.05 mg/100 g) as compared to (12.438±10.4 mg/100 g) in *C. rutidosperm*a. This result shows that both the plant leaves are good sources of magnesium. Magnesium is a mineral that is important for normal bone structure in the body. Romani [33] expressed that a low magnesium levels in the body have been linked to diseases such as osteoporosis, high blood pressure, clogged arteries, hereditary heart disease, diabetes, and stroke. Report according to Ayuk and Gittoes [34], expressed that magnesium aids in the chemical reactions in the body, intestinal absorption, and also prevents heart diseases and high blood pressure.

The concentration of sodium in the plant leaves are 2.572± 0.42 mg/100 g and 2.659±0.80 mg/100 g for *T. occidentallis and C. rutidosperm*a respectively. The amount of sodium recorded in the studied plant leaves are very low compared to the recommended level by NAFDAC [35] (3000 mg/100 g). Sodium has an important role in maintenance of normal acid-base balance. An adult need about 3 g per day of sodium but modern diatery habits take in 5 – 20 per day [36].

## 3.4 Proximate Compositions

Table 5 presents the results of the proximate compositions for *T. occidentallis* and *C. rutidosperma* plant leaves. These results showed that both plants contain appreciable amount of protein which indicates further that they can both serve as essential ingredient for building and repairing of body tissues, regulation of body processes and formation of enzymes and hormones. The fiber content was higher in *Cleome rutidosperma* than for *Telfairia occidentallis*, this showed that they can help in keeping the digestive system healthy and functioning properly. Fiber aids and speeds up the excretion of waste and toxins from the body, preventing them from sitting in the intestine or bowel for too long [37]. The low percentage of fat contents in both plants could be an advantage in the diets of people based on age and body mass. That means that the low lipid content in these vegetables could be an advantage by helping uptake of water soluble vitamins. More so, Carbohydrate-rich *Cleome rutidosperma* could *increase* glucose metabolism leading to the production of pyruvate and energy. Pyruvate is known to be the preferred substrate essential for the activity and survival of sperm cells [38].

**Table 3. Anti-nutrient compositions of *Telfairia occidentallis* and *Cleome rutidosperma* plant leaves (mg/100 g dry weight)**

| Components | *T. occidentallis* | *C. rutidosperma* | WHO/FAO (mg/100 g) |
|---|---|---|---|
| Hydrocyanic Acids | 31.0±0.001 | 25.0±0.001 | 35 |
| Oxalate | 570±0.004 | 740±0.003 | 2000 |
| Phytic acid | 7.50±0.002 | 9.20±0.005 | 5 |

*Results were presented as mean ± SD of triplicate determinations*

**Table 4. Mineral compositions of *T. occidentallis* and *C. rutidosperma* plant leaves (mg/100 g dry weight)**

| Elements | *T. occidentallis* | *C. rutidosperma* | NAFDACStandards (mg/100 g) |
|---|---|---|---|
| Mn | 1.684±0.40 | 0.718±0.31 | 2 |
| Fe | 4.329±0.01 | 3.823±0.03 | 500 |
| Zn | 1.740±0.10 | 1.570±0.31 | 500 |
| Na | 2.572±0.42 | 2.659±0.80 | 3000 |
| Ca | 74.405±13.60 | 29.677±13.50 | 3000 |
| Mg | 35.277±10.05 | 12.438±10.4 | 2000 |
| Cu | 0.049±0.03 | 0.044±0.01 | 500 |

*Results were presented as mean ± SD of triplicate determinations*

**Table 5. Proximate composition for *Telfairia occidentallis* and *Cleome rutidosperma* plant leaves (%)**

| Components | *T. occidentallis* | *C. rutidosperma* |
|---|---|---|
| Protein | 35.75±0.07 | 12.46±0.01 |
| Fat | 9.67±0.03 | 4.73±0.02 |
| Fiber | 7.31±0.31 | 16.33±0.02 |
| Ash | 8.12±0.07 | 5.27±0.03 |
| Moisture | 9.29±0.05 | 9.15±0.01 |
| CHO | 29.86±0.29 | 52.06±0.04 |

*Results were presented as mean ± SD of triplicate determinations*

## 4. CONCLUSION

Vegetables are very important part of our diets. This study has demonstrated that the two studied vegetables *Telfairia occidentallis* and *Cleome srutidosperma* contains some of the biologically active phytochemicals which include Alkaloid, flavonoids and Tannins. *Cleome rutidosperma* contains relatively higher phytochemicals than *Telfairia occidentallis.* The anti-nutrient composition for the plant leaves of *T. occidentallis* and *C. rutidosperma* were low compared to the WHO standard. More so, this study had shown that *T. occidentallis* contains higher mineral composition than *Cleome rutidosperma*, this showed that *T. occidentallis* is a good source of minerals which can serve as supplement to meet the daily requirement for minerals in human body. The data obtained in the present work will be useful in the synthesis of new drugs of pharmaceutical importance through our local plants. Although, the anti-nutrient contents found in both *Telfairia occidentallis* and *Cleome rutidosperma* were low, it will still be safer if these leaves were boiled for about 5 to 15 minutes to reduce the anti-nutritional factors significantly.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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